

TITLE OF THE INVENTION

WASHING MACHINE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Korean Patent Application No. 2003-36581, filed June 7, 2003 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to washing machines and, more particularly, to a washing machine which has a door-locking unit that smoothly and reliably locks and unlocks a door to a cabinet of the washing machine.

2. Description of the Related Art

[0003] Generally, washing machines have been typically classified into vertical shaft type washing machines in which a rotary tub is installed in a cabinet along a vertical axis, and drum type washing machines in which a rotary tub is installed in a cabinet along a horizontal axis. In the vertical shaft type washing machines, a pulsator is arranged in the rotary tub and is rotated around the vertical axis of the cabinet in opposite directions, thus producing forced water currents which wash laundry. The cabinet is open at its top. A door is mounted to an open top of the cabinet, thus allowing a user to place and remove laundry into and from the rotary tub.

[0004] Meanwhile, the drum type washing machines are designed such that the rotary tub is horizontally set in the cabinet and is rotated around a horizontal axis of the cabinet in opposite directions. The washing machine repeatedly moves the laundry upward by being seated on the internal surface of the rotary tub and allows the laundry to fall from the top to the bottom inside the rotary tub due to gravity, thus washing the laundry.

[0005] In the drum type washing machines, the rotary tub is rotatably set in a water tub which contains water, and is rotated by a drive motor. The cabinet is open in front to form an opening. A door is rotatably mounted to the open front of the cabinet, thus allowing a user to place and remove laundry into and from the rotary tub.

[0006] The door is hinged at an end to an edge of the opening of the cabinet. A door-locking unit is provided at a free end which is opposite to the hinged end of the door, so as to lock and unlock the door to and from the cabinet, thus keeping the door locked to the cabinet during an operation of the drum type washing machine, and allowing the door to be unlocked from the cabinet when the operation of the drum type washing machine has been completed.

[0007] However, since the conventional door-locking unit has an excessively complicated construction, it takes a long time to assemble the door-locking unit, thus reducing productivity. Due to the complicated construction, the door-locking unit is not reliably and smoothly operated to lock and unlock the door to and from the cabinet of the washing machine. Further, it is difficult to check out and repair the door-locking unit.

SUMMARY OF THE INVENTION

[0008] Accordingly, it is an aspect of the present invention to provide a washing machine having a door-locking unit which has a simple construction, and is smoothly and reliably operated to lock and unlock a door to a cabinet of the washing machine.

[0009] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0010] The above and/or other aspects are achieved by providing a washing machine, including a cabinet, a door, and a door-locking unit. The cabinet has an opening at a portion thereof. The door opens and closes the opening of the cabinet. The door-locking unit is operated to lock and unlock the door to the cabinet, and includes a handle, a latch, and an elastic unit. The handle is hinged to a first hinge unit which is provided on a position of the door. The latch is hinged to a second hinge unit which is provided on a position of the door, and is rotated by an operation of the handle to lock and unlock the door to the cabinet. The elastic unit is placed on the second hinge unit to elastically bias the latch in a direction where the latch is locked to the cabinet.

[0011] The handle may include first and second lever parts which are integrated with each other to be rotated around the first hinge unit. The latch may include third and fourth lever parts which are integrated with each other to be rotated around the second hinge unit. The third lever part may be placed in contact with the second lever part, and the fourth lever part may be positioned toward an interior of the cabinet. Thus, when the first lever part of the handle is pulled, the elastic unit may be compressed and the second lever part of the handle may push the third lever part of the latch, thus allowing the fourth lever part of the latch to be unlocked from the cabinet.

[0012] The fourth lever part may have a hook at an end, and the cabinet may have a hook hole at a position to receive the hook of the fourth lever part, thus allowing the hook to be removably locked to the cabinet.

[0013] The first lever part of the handle may have a longer length than the second lever part of the handle, thus allowing the first lever part of the handle to be pulled with a small force.

[0014] The door may include a transparent part which allows a user to see the interior of the cabinet, and a frame which is mounted to an edge of the transparent part. The frame may be open at a central portion to allow the user to reach the first lever part of the handle. The first and second hinge units may be provided on an inner surface of the frame spaced apart from each other by an interval, thus supporting the handle and the latch in a hinging method.

[0015] A through hole may be provided at a portion of the transparent part to correspond to the hook hole of the cabinet, thus allowing the fourth lever part of the latch to pass through the through hole to face the hook hole.

[0016] The handle may further include a first hinge shaft which is integrated with the first and second lever parts while latitudinally extending at a position between the first and second lever parts. The first hinge unit may include first and second seats which are spaced apart from each other by an interval, thus allowing opposite sides of the first hinge shaft to be seated in the first and second seats, respectively.

[0017] Each of the first and second seats may include a stopper which stops an end of the first hinge shaft so that the first hinge shaft is held in the first and second seats, and support projections which are placed at various positions of the frame inside the stopper. Each of the

support projections may have an opening at their centers to rotatably support the first hinge shaft.

[0018] The second hinge unit may include first and second support members which project from the frame spaced apart from each other by an interval which is wider than a width of the latch, thus rotatably supporting a hub of the latch provided between the third and fourth lever parts.

[0019] A hinge hole may be provided at a position of the hub of the latch to allow a second hinge shaft, around which the latch is rotated, to pass through the hub of the latch. Opposite ends of the second hinge shaft may be respectively supported by the first and second support members, thus allowing the latch to be rotatably supported on the frame.

[0020] First and second brackets may be provided on opposite sides of the through hole of the transparent part, and each of the first and second brackets may have a hole to allow the second hinge shaft to pass through the first and second brackets, thus allowing the latch to be mounted to the transparent part by passing the second hinge shaft through the holes of the first and second brackets and the hinge hole of the hub of the latch while the hub of the latch is placed between the first and second brackets.

[0021] The elastic unit may include first and second coil parts, and a connecting part. The first coil part may be provided between the hub of the latch and the first bracket, and the second coil part may be provided between the hub of the latch and the second bracket. The connecting part may connect the first coil part to the second coil part, and may be placed on the third lever part of the latch to be rotated by a rotation of the third lever part. Thus, the first and second coil parts are compressed or restored to their original states by a rotation of the connecting part, thus providing an elastic force to the latch.

[0022] Additional aspects and/or other advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the following embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a perspective view of a drum type washing machine having a door-locking unit, according to a first embodiment of the present invention;

FIG. 2 is an exploded perspective view of the door-locking unit of FIG. 1, with the door-locking unit installed in a door;

FIG. 3 is an enlarged perspective view to show a handle of the door-locking unit of FIG. 2, which is coupled to a first hinge unit provided on an inner surface of the door;

FIG. 4 is an enlarged perspective view to show a latch of the door-locking unit of FIG. 2, which is coupled to a second hinge unit provided on the inner surface of the door;

FIGS. 5 and 6 are sectional views taken along the line II - II of FIG. 2, in which FIG. 5 shows the door locked to a cabinet by the door-locking unit of FIG. 2, and FIG. 6 shows the door unlocked from the cabinet by the door-locking unit of FIG. 2; and

FIG. 7 is a perspective view of a latch of a door-locking unit, according to a second embodiment of the present invention, in which an elastic unit that is provided on the latch to elastically bias the latch is positioned in a manner different from the first embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0024] Reference will now be made in detail to embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below to explain the present invention by referring to the figures.

[0025] FIG. 1 is a perspective view of a drum type washing machine having a door-locking unit 10, according to a first embodiment of the present invention. As shown in FIG. 1, the drum type washing machine includes a box-shaped cabinet 1. The cabinet 1 has an opening 2 at its front to allow a user to place and remove laundry into and from, respectively, the cabinet 1. A water tub (not shown) and a rotary tub 3 are set in the cabinet 1 along a horizontal axis. A door 4 is mounted to a position of the cabinet 1 to open and close the opening 2 of the cabinet 1.

[0026] The door 4 is rotatably hinged to the cabinet 1 by a hinge unit 5 which is mounted to an end of the door 4. Thus, when the washing machine is not operated, the door 4 is opened to

allow the laundry to be put into or taken out from the cabinet 1. Conversely, when the washing machine is operated, the door 4 is closed, thus allowing the laundry to be washed.

[0027] A door-locking unit 10 is mounted to an end of the door 4, which is opposite to the end having the hinge unit 5. The door-locking unit 10 functions to keep the door 4 locked to the cabinet 1, during an operation of the washing machine. Meanwhile, when the washing machine is stopped, the door-locking unit 10 functions to unlock the door 4 from the cabinet 1. To allow the door-locking unit 10 to be locked to and unlocked from the cabinet 1, a hook hole 6 having a particular size is provided on a predetermined portion of the cabinet 1. The hook hole 6 has an inclined surface.

[0028] The construction and operation of the door-locking unit 10, according to the first embodiment of the present invention, will be described in the following with reference to FIGS. 2 to 6.

[0029] FIG. 2 is an exploded perspective view of the door-locking unit 10 installed in the door 4. FIG. 3 is an enlarged perspective view to show a handle 20 of the door-locking unit 10, which is coupled to a first hinge unit 40 provided on an inner surface of the door 4. FIG. 4 is an enlarged perspective view to show a latch 30 of the door-locking unit 10, which is coupled to a second hinge unit 45 provided on the inner surface of the door 4. FIG. 5 is a sectional view to show the door 4 locked to the cabinet 1 by the door-locking unit 10, and FIG. 6 is a sectional view to show the door 4 unlocked from the cabinet 1 by the door-locking unit 10.

[0030] As shown in FIG. 2, the door 4 includes a transparent part 4a and a frame 4b. The transparent part 4a has a central portion which is made of a transparent material, thus allowing the user to see an interior of the cabinet 1 (see FIG. 1). The frame 4b is screwed to an edge of the transparent part 4a by screws 7, and has an opening 8 at a central portion of the frame.

[0031] The door-locking unit 10 is provided between the transparent part 4a and the frame 4b of the door 4, and provided with the handle 20 and the latch 30. The user manipulates the handle 20 through the opening 8 of the frame 4b. The latch 30 is rotated by an operation of the handle 20 to lock and unlock the door 4 to and from the cabinet 1.

[0032] The first and second hinge units 40 and 45 are provided on the inner surface of the frame 4b to be spaced apart from each other by an interval so that the handle 20 is rotatably

mounted to the first hinge unit 40, and the latch 30 is rotatably mounted to the second hinge unit 45. Further, a through hole 9 is provided at a portion of the transparent part 4a. Such a construction allows the latch 30 of the door-locking unit 10 to engage with a hook hole 6 which is provided at a position of the cabinet 1.

[0033] As shown in FIG. 3, the handle 20 is positioned on the inner surface of the frame 4b to face the inner surface, and includes a first hinge shaft 21 which is extended latitudinally. First and second lever parts 22 and 23 extend from the first hinge shaft 21 in opposite directions and are integrated with each other. The first lever part 22 has a wider width and a longer length than the second lever part 23, thus allowing the user to easily manipulate the handle 20.

[0034] The first hinge unit 40 includes first and second seats 41 and 42 which are spaced apart from each other by an interval, thus rotatably supporting the first hinge shaft 21. Each of the first and second seats 41 and 42 includes a stopper 43 and a plurality of support projections 44. The stopper 43 functions to stop an end of the first hinge shaft 21 so that the first hinge shaft 21 is held in the first and second seats 41 and 42. The plurality of support projections 44 are placed at positions of the frame 4b inside the stopper 43. Each of the support projections 44 has an opening 44a at its center to rotatably support the first hinge shaft 21.

[0035] Thus, when opposite ends of the first hinge shaft 21 of the handle 20 are respectively seated in the first and second seats 41 and 42 of the first hinge unit 40, the first hinge shaft 21 is rotatably supported in the openings 44a of the plurality of support projections 44 while being held in the first and second seats 41 and 42 by the stoppers 43.

[0036] As shown in FIG. 4, the latch 30 includes a hub 31 and third and fourth lever parts 32 and 33 which are integrated with each other. The hub 31 is supported by the second hinge unit 45, and forms a center of a rotation of the latch 30. The third lever part 32 extends from the hub 31 to be horizontal relative to the transparent part 4a and the frame 4b. The fourth lever part 33 extends from the hub 31 to the interior of the cabinet 1 while being perpendicular to the transparent part 4a and the frame 4b.

[0037] A hinge hole 35 is axially formed through the hub 31, and a second hinge shaft 34 passes through the hinge hole 35. Such a construction allows the latch 30 to be rotated around the second hinge shaft 34.

[0038] First and second brackets 36 each having a hole 37 project vertically from the transparent part 4a at opposite sides of the through hole 9, and rotatably support the latch 30 on the transparent part 4a by the second hinge shaft 34 between first and second support members 46 and 47 of the second hinge unit 45.

[0039] The third lever part 32 of the latch 30 is placed in contact with an inner surface of the second lever part 23 of the handle 20 (see FIGS. 5 and 6). Thus, when the first lever part 22 of the handle 20 is pulled, the third lever part 32 of the latch 30 is pushed by the second lever part 23.

[0040] The fourth lever part 33 is arranged to be perpendicular to the third lever part 32. A hook 33a is provided at an end of the fourth lever part 33 perpendicular to the fourth lever part 33. The fourth lever part 33 having the hook 33a outwardly extends from the through hole 9 of the transparent part 4a to face the cabinet 1. Thus, when the fourth lever part 33 is inserted into the hook hole 6 of the cabinet 1 to make the hook 33a locked by the hook hole 6, the door 4 is locked to the cabinet 1. Conversely, when the hook 33a is removed from the hook hole 6, the door 4 is unlocked from the cabinet 1.

[0041] Further, an elastic unit 50 is provided on the latch 30. When the latch 30 is rotated by the handle 20, the elastic unit 50 is rotated along with the latch 30 to be compressed. Meanwhile, when a force applied to the handle 20 is removed, the latch 30 and the handle 20 are restored to their original positions by the elastic unit 50.

[0042] The elastic unit 50 includes first and second coil parts 51 and 52 through which the second hinge shaft 34 passes. The first and second coil parts 51 and 52 are compressed by the rotation of the latch 30, and provide an elastic force to the latch 30 sufficient to elastically restore the latch 30 to its original position. A connecting part 53 connects the first coil part 51 to the second coil part 52. First and second free ends 54 and 55 respectively extend from the first and second coil parts 51 and 52.

[0043] After the first and second coil parts 51 and 52 of the elastic unit 50 are respectively positioned at opposite sides of the hub 31 of the latch 30, and the connecting part 53 of the elastic unit 50 is placed in contact with the third lever part 32 of the latch 30, the hub 31 of the latch 30 is arranged between the first and second brackets 36 of the transparent part 4a. Thereafter, the second hinge shaft 34 is passed through the holes 37 of the first and second

brackets 36 and the hinge hole 35 of the hub 31 of the latch 30. In this way, the latch 30 and the elastic unit 50 are assembled with the transparent part 4a. In this case, the fourth lever part 33 of the latch 30 extends from the through hole 9 of the transparent part 4a toward the cabinet 1 while being perpendicular to the transparent part 4a. The third lever part 32 of the latch 30 extends toward a center of the transparent part 4a while being parallel to the transparent part 4a.

[0044] The second hinge unit 45 includes the first and second support members 46 and 47 which project from the frame 4b while being perpendicular to the inner surface of the frame 4b. The first and second support members 46 and 47 are spaced apart from each other to support opposite ends of the second hinge shaft 34 so that the second hinge shaft 34 is held in the first and second support members 46 and 47.

[0045] Thus, when the second hinge shaft 34 is placed between the first and second support members 46 and 47 of the second hinge unit 45 after the latch 30 having the elastic unit 50 is mounted to the transparent part 4a by the second hinge shaft 34, the hub 31 of the latch 30 is supported by the frame 4b while being rotatably seated between the first and second support members 46 and 47 of the second hinge unit 45.

[0046] Further, when the latch 30 is placed in the second hinge unit 45 of the frame 4b, the third lever part 32 of the latch 30 contacts the second lever part 23 of the handle 20. Thus, the third lever part 32 of the latch 30 is rotated by the operation of the handle 20.

[0047] The operation of the door-locking unit 10, according to the first embodiment of the present invention, will be described in the following with reference to FIGS. 5 and 6.

[0048] As shown in FIG. 5, when the door 4 is locked to the cabinet 1 by the door-locking unit 10, the first hinge shaft 21 of the handle 20 is seated in the first and second seats 41 and 42 of the first hinge unit 40 (see FIG. 3). At this time, the first and second lever parts 22 and 23 of the handle 20 are placed parallel to the transparent part 4a and the frame 4b between the transparent part 4a and the frame 4b. Further, the hub 31 of the latch 30 and the elastic unit 50 are supported between the first and second support members 46 and 47 of the second hinge unit 45 (see FIG. 4), while the third lever part 32 of the latch 30 is placed on the second lever part 23 of the handle 20 parallel to the transparent part 4a and the frame 4b. The fourth lever part 33 of the latch 30 passes through the through hole 9 of the transparent part 4a and the

hook hole 6 of the cabinet 1 so that the hook 33a provided at the end of the fourth lever part 33 is locked by the cabinet 1, thus allowing the door 4 to be kept closed.

[0049] The first coil part 51 of the elastic unit 50 is wound around the second hinge shaft 34 between the first bracket 36 and the hub 31 of the latch 30 while not being compressed. Further, the second coil part 52 of the elastic unit 50 is wound around the second hinge shaft 34 between the second bracket 36 and the hub 31 of the latch 30 while not being compressed. The connecting part 53 of the elastic unit 50 is provided between the third lever part 32 of the latch 30 and the second lever part 23 of the handle 20. The first and second free ends 54 and 55 of the elastic unit 50 are in contact with the inner surface of the frame 4b (see FIG. 4).

[0050] An actuating part 56 of a locking sensor is provided inside the hook hole 6 of the cabinet 1. The actuating part 56 is pushed by the hook 33a, and elastically restores an original position of the hook 33a when the hook 33a does not impose a pushing force on the actuating part 56, thus detecting whether the door 4 is locked to the cabinet 1 or not. When the door 4 is locked to the cabinet 1 by the door-locking unit 10, the washing machine is operated to wash the laundry.

[0051] In a state where the door 4 is locked to the cabinet 1, when the user desires to place or remove laundry into or from the cabinet 1, the user puts a hand in the opening 8 of the frame 4b to pull the first lever part 22 of the handle 20, as shown in FIG. 6. At this time, the first hinge shaft 21 is rotated so that the first and second lever parts 22 and 23 are rotated counterclockwise. Simultaneously, the second lever part 23 pushes the third lever part 32 of the latch 30 toward the cabinet 1.

[0052] In this case, the hub 31 of the latch 30 is rotated around the second hinge shaft 34, so that the third and fourth lever parts 32 and 33 are rotated clockwise, as shown in FIG. 6. Thus, the hook 33a of the fourth lever part 33 is moved to a position which is easily removed from the hook hole 6 of the cabinet 1. Further, the connecting part 53 of the elastic unit 50 is rotated along with the third lever part 32, thus compressing the first and second coil parts 51 and 52.

[0053] In a state where the first lever part 22 of the handle 20 is pulled as described above, the frame 4b is pulled forward. At this time, the fourth lever part 33 of the latch 30 is removed from the hook hole 6, thus allowing the door 4 to be opened. Further, the actuating part 56 of the locking sensor elastically restores the original position of the locking sensor, thus detecting the opening of the door 4.

[0054] Meanwhile, when the user releases the handle 20, the latch 30 is rotated counterclockwise by the elastic force of the elastic unit 50, and simultaneously the handle 20 is rotated clockwise, thus allowing the door-locking unit 10 to be restored to its original position.

[0055] When the user pushes the opened door 4 toward the cabinet 1, the hook 33a enters the hook hole 6 of the cabinet 1. At this time, the fourth lever part 33 of the latch 30 is moved along the inclined surface of the hook hole 6 and rotated clockwise. After the hook 33a enters the hook hole 6, the fourth lever part 33 is elastically rotated counterclockwise. Thus, the door 4 is locked to the cabinet 1, as shown in FIG. 5, thus allowing the washing machine to be operated.

[0056] FIG. 7 shows a door-locking unit, according to a second embodiment of the present invention. The general construction of the door-locking unit of the second embodiment remains the same as the door-locking unit 10 of the first embodiment, except that an elastic unit 50a is placed in a manner different from the elastic unit 50 of the door-locking unit 10 of the first embodiment.

[0057] According to the second embodiment, the elastic unit 50a includes first and second coil parts 51 and 52 which are placed on opposite sides of the hub 31 of the latch 30. A connecting part 53 is provided on an inner surface of the third lever part 32 of the latch 30, and connects the first coil part 51 to the second coil part 52. First and second free ends 54 and 55 extend upwardly from the first and second coil parts 51 and 52, respectively. Thus, when the third lever part 32 of the latch 30 is rotated clockwise, the connecting part 53 is also rotated, thus compressing the first and second coil parts 51 and 52. Meanwhile, when a force applied to the handle 20 is removed, the latch 30 is rotated counterclockwise by a restoring force of the first and second coil parts 51 and 52.

[0058] Since the construction and operation of the door-locking unit of the second embodiment is similar to the door-locking unit of the first embodiment which is shown in FIGS. 2 to 6, the door-locking unit of the second embodiment will not be described herein in detail.

[0059] According to the above-discussed embodiments of the present invention, the door-locking unit is applied to the drum type washing machine. However, without being limited to these embodiments, the door-locking unit may be applied to devices other than the drum type washing machine, to lock and unlock a door. For example, when the door-locking unit of the present invention is applied to vertical shaft type washing machines with a heater to wash

laundry using hot water, in which a rotary tub is installed in a cabinet along a vertical axis, and a pulsator is arranged in the rotary tub and is rotated around the vertical axis of the cabinet in opposite directions, thus producing water currents to wash the laundry, the vertical shaft type washing machines are safely operated.

[0060] As is apparent from the above description, the present invention provides a washing machine having a door-locking unit which includes a handle rotated around a first hinge unit, a latch rotated around a second hinge unit by the operation of the handle, and an elastic unit to provide an elastic force to the latch. The door-locking unit is easily mounted to a door, thus enhancing productivity, and allows the door to be smoothly and reliably locked to and unlocked from a cabinet, thus having beneficial qualities.

[0061] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.